NRDC Title 20 Recommendations for Electronics Products

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NRDC

August 31, 2011

Benefits summary of NRDC recommendations for electronics

	CA Economy Annual Savings ($M/yr)	Annual Energy Savings[1] (GWh/yr)	500 MW Power Plants Equivalent	CO2 Emissions (million tons CO2e/yr)	CA Households Annual Electricity
Personal Computers	$120-$310	1,000-2,500	0.3-0.9	0.5-1.2	140,000-350,000
Servers	$60-$120	540-1,030	0.2-0.3	0.3-0.4	70,000-140,000
Set Top Boxes	$210	1,750	0.6	0.9	240,000
Game Consoles	$70	570	0.2	0.3	80,000
Total	**$460-$710**	**3,800-5,800**	**1.3-2.0**	**1.9-2.8**	**500,000-800,000**

1. After stock turnover

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Summary: Savings potential from Title 20 standard on electronics products

- $400 million to over $0.7 billion in annual electricity costs to Californians
- The equivalent output from 1.3 to 2 large power plants (500MW)
- The annual electricity use of all the households in the cities of San Jose, San Francisco and Oakland

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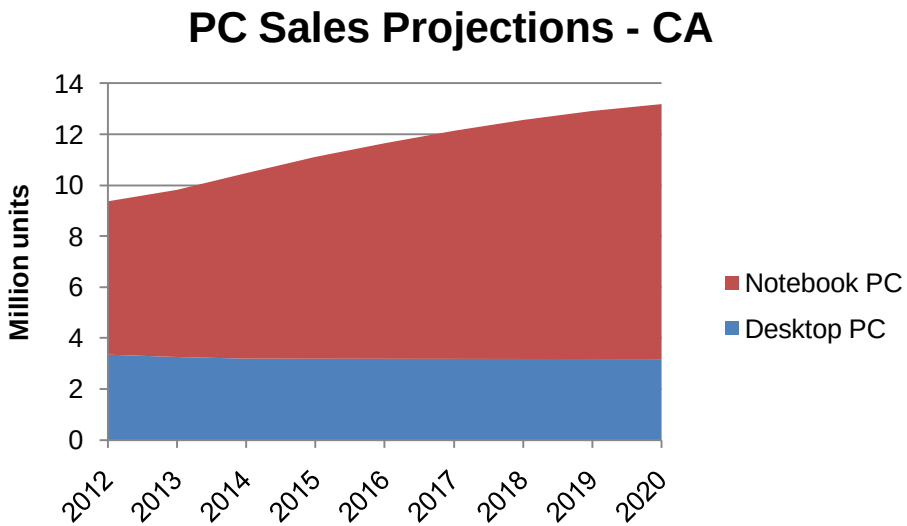
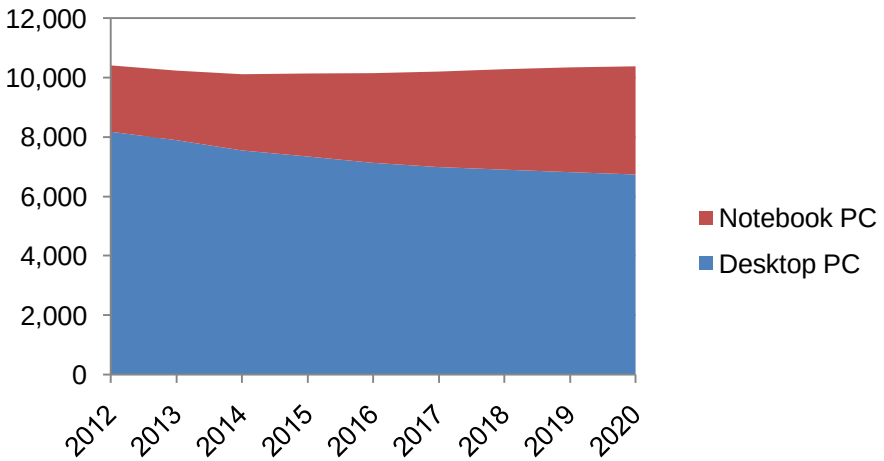
1. COMPUTERS AND SERVERS   
2. SET TOP BOXES
3. GAME CONSOLES

Personal computers: desktops, note/netbooks, workstations, thin clients

PC market growth has slowed, but still strongly positive (80% growth expected by 2020[1])

PC stock energy use projected to remain stable around 10 TWh[2] in CA through 2020 without policy intervention.

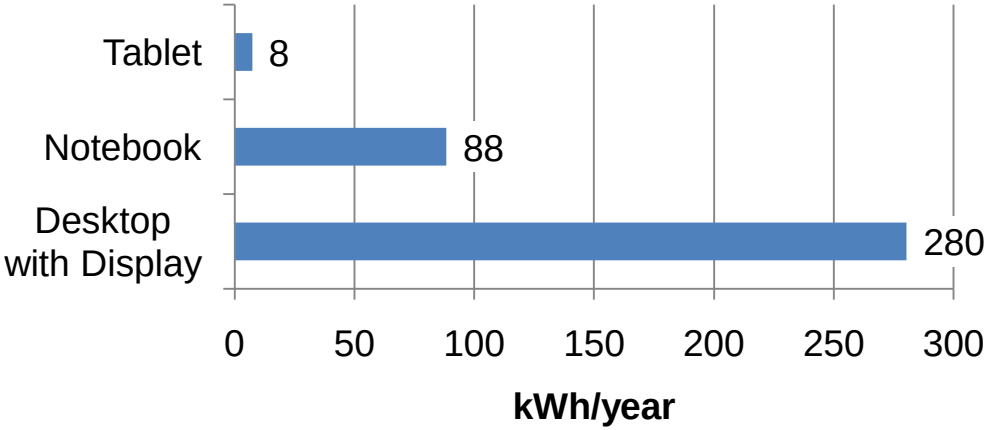




(1) NRDC estimates based on IDC 2015 projections

(2) NRDC estimates, to be refined with Energy Star v6 data set

Comparison with tablets indicates large margin for efficiency improvements in desktops and notebooks



Based on product samples, not necessarily exact representation of market average

- Large differences in energy use reflect more than performance differences: desktops use less efficient components and system architectures
- Tablets demonstrate that computing devices of similar capabilities and prices can have radically lower power use

(1) iPad2 , Energy Star 5 Category B desktop and notebook, 50% with Energy Star duty cycle, 50% with no power management, desktop includes 20-inch monitor, notebook includes monitor energy

Largest energy savings opportunities in computers

Component	Share of energy use	Savings opportunities
Power Supply	15-35%	• 80-Plus Bronze: <70% to 82% efficiency
Display	15-30%	• LED backlighting, more efficient panel technology
Motherboard	15-20%	• More efficient chipsets, voltage regulators and other components, mobile-on-desktop design
GPU	0-50%	• Higher power proportionality: low power in idle
CPU	5-15%	• Low power CPUs, voltage and frequency scaling
Disks	5-10%	• “Green” drives, solid state drives (SSD)
Memory	5-10%	• “Green” memory
Networking	2-8%	

System-level strategies	
• Advanced power management	• Graphics switching

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Straw man standard proposal

Key elements in standard should include:

- Internal power supplies: minimum efficiency requirement
- Power limits in Idle, Sleep, Off, Networked Standby modes (within duty-cycle formula or individual modal caps)
- Power management enabled by default from factory
- Consumer label: lifetime operating cost and energy use

Note: Not recommending cap on active mode, only on idle and low-power modes when PC is providing no processing-intensive function to user.

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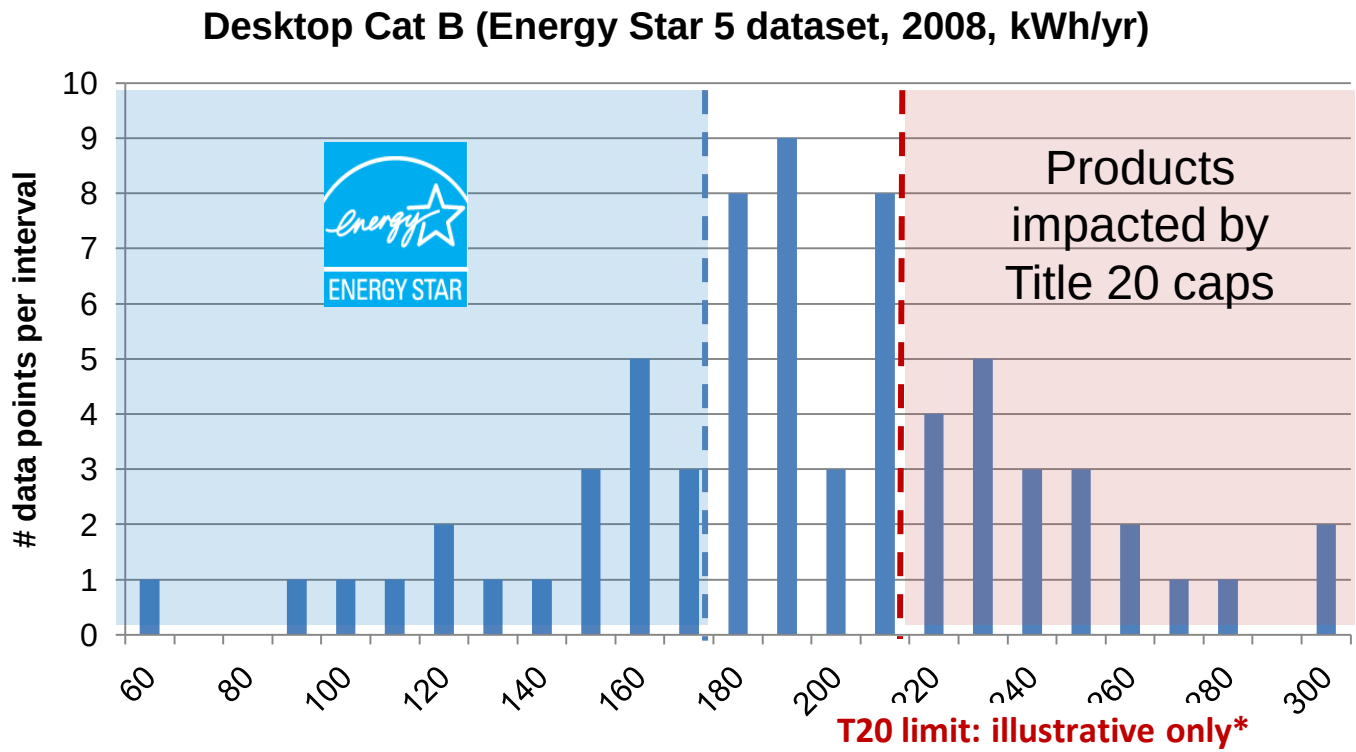
Power limits: targeting the worst energy performers



- System-level caps will require the worst energy performers in market to meet minimum efficiency standards
- Functionality and performance-neutral through category-based caps and capability adjustments

(*) Data and proposed threshold to be updated with Energy Star 6 data set

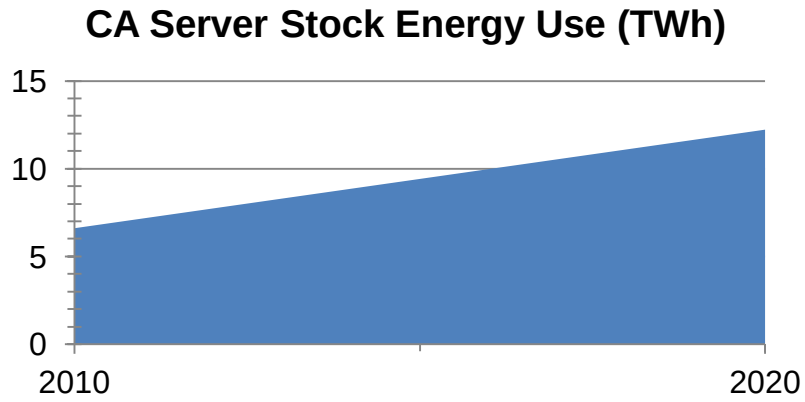
Computers servers

California server sales, 2010[1]

Volume Servers	Mid-range Servers	High-End Servers
320,400	5,640	550

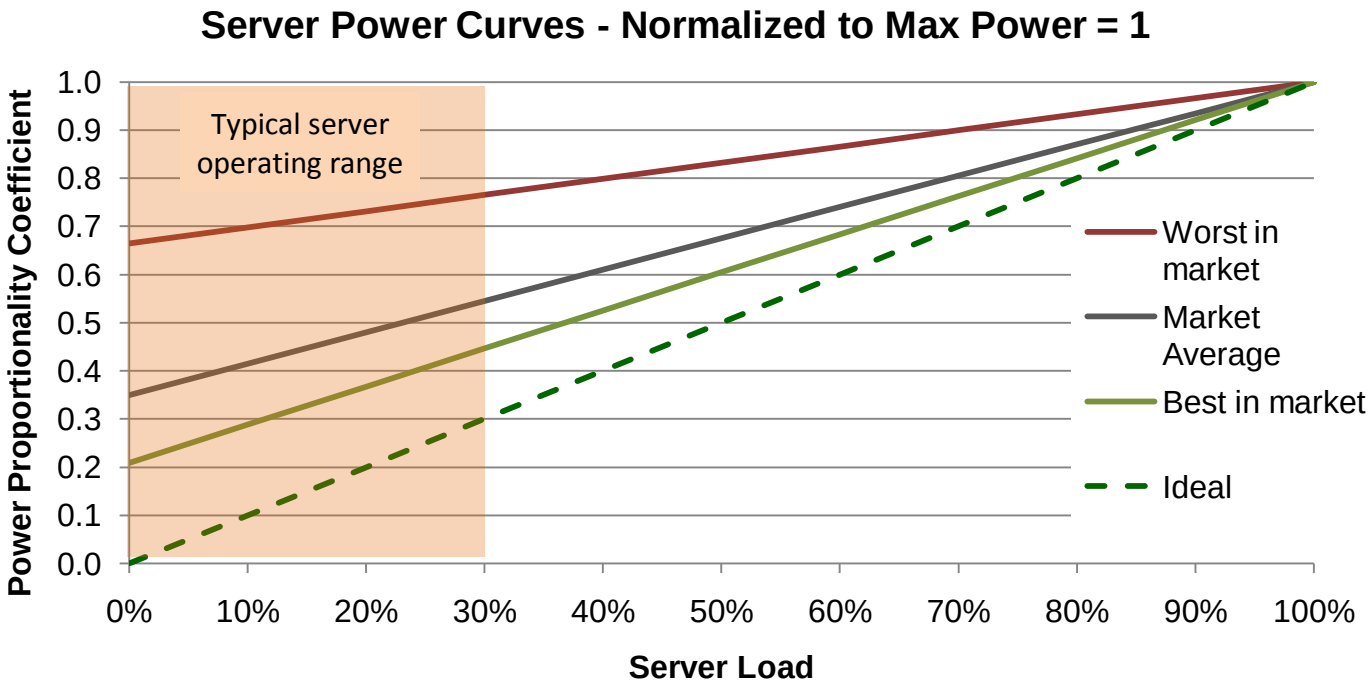
(1) IDC 2011, extrapolated per CA/US population ratio

Server energy use projected to grow 85% by 2020, due to data explosion trend[2]:



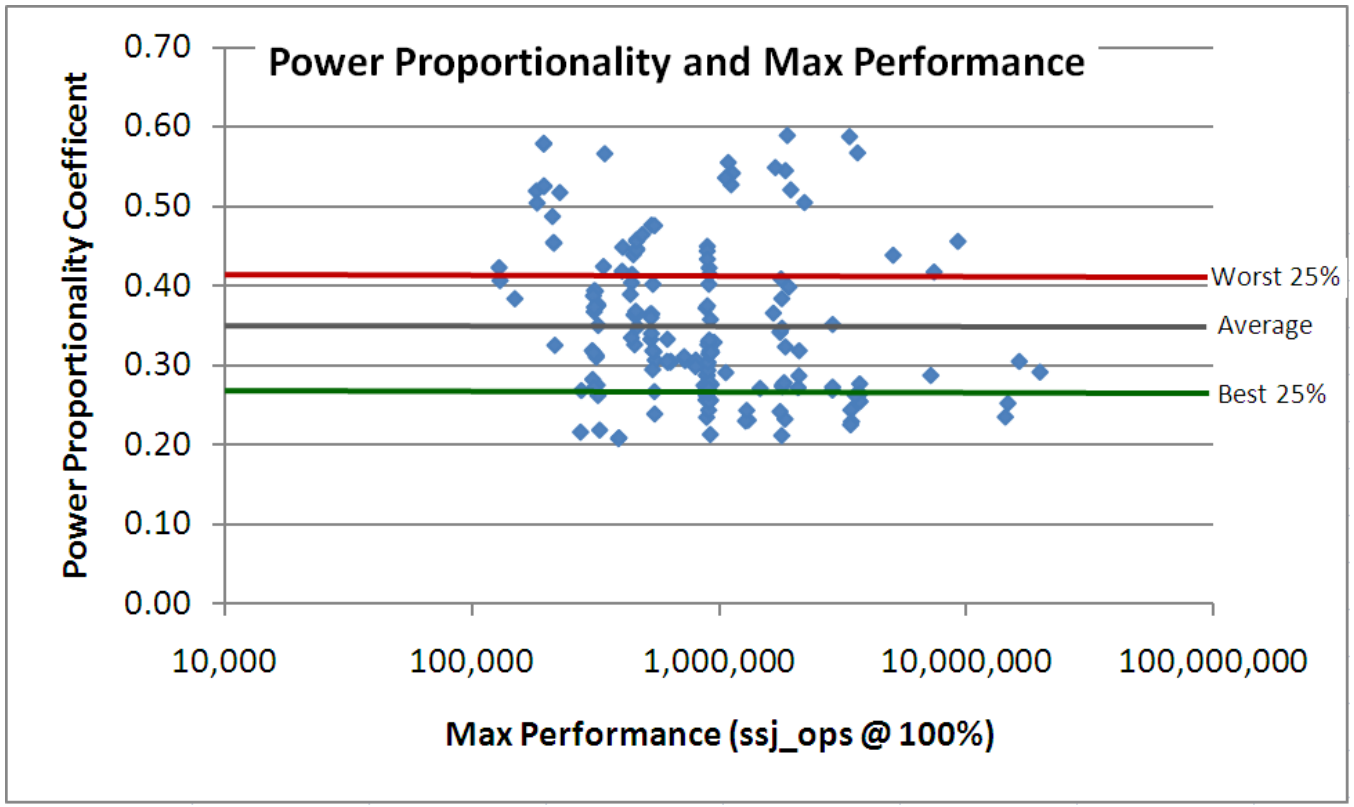
(2) Koomey 2011 extrapolated per 2005-2010 growth rate. Includes cooling associated with servers.

Poor server power proportionality responsible for large energy waste in CA server rooms



- Servers are selected for their peak capacity, but spend majority of time and energy in 0-30% load range, where much energy is wasted due to poor power proportionality

Minimum power proportionality standard



- Possible standard approach: eliminate servers with worst power proportionality from market (within appropriate workload and reliability categories)

Servers power savings opportunities

Main opportunities to save energy in servers:

- Power supplies: eliminate the most inefficient power supplies from the market
- Efficient motherboards: voltage regulator modules (VRMs) and other components
- Efficient disks (eg. SSD, “green drives”…)
- Efficient memory (“green DDR3”)
- High efficiency server layouts and fans
- New server architectures such as Intel Atom and ARM-based servers

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Straw man standard proposal

Key elements in standard should include:

- Power supply efficiency requirements

- Power proportionality requirements (min/max power ratio), within workload and reliability categories

  OR

- Power caps in idle, per Energy Star for Servers v1

  OR

- Adaptation of Energy Star for Servers v2 (under development) for mandatory standard

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Computers and servers savings estimates

	Computers	Servers
Cost savings CA economy* ($ million/year)	$120-$310	$60-$120
Lifetime unit electricity cost savings	$15-$150	$200-$700
Energy savings (GWh/year)	1,000-2,500	540-1,030
Power generation avoided (MW)	170-430	90-180
CO2 emissions avoided (Thousand Tons CO2e)	500-1,250	270-380
CA Households electricity use (thousands)	140-350	70-140

(*) After stock turnover

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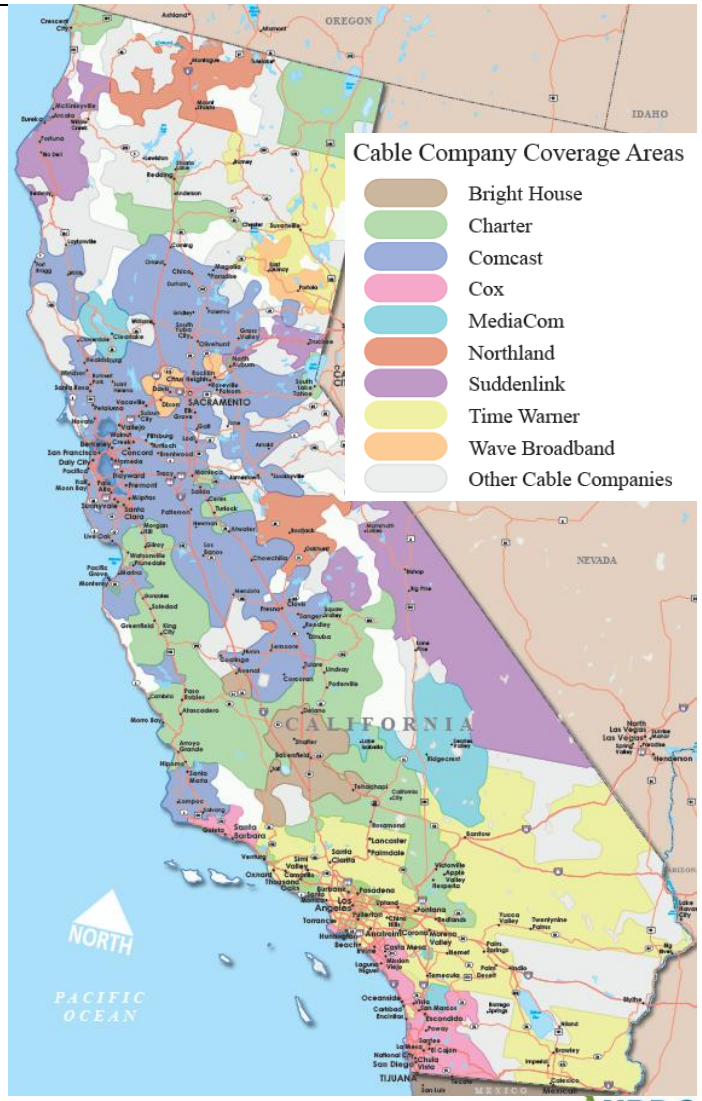
The Landscape – around 17 million STBs installed statewide

Service Providers:

- Cable: 6.8 M subscribers
  - Comcast and Time Warner dominate
- Satellite: 3.8 M subscribers
  - DirecTV and Dish Networks
- Telecom: 0.5 M subscribers

Hardware Manufacturers:

- Approximately 8 box manufacturers, all of which have ENERGY STAR qualifying models. Biggest suppliers include Motorola, Cisco and Pace.



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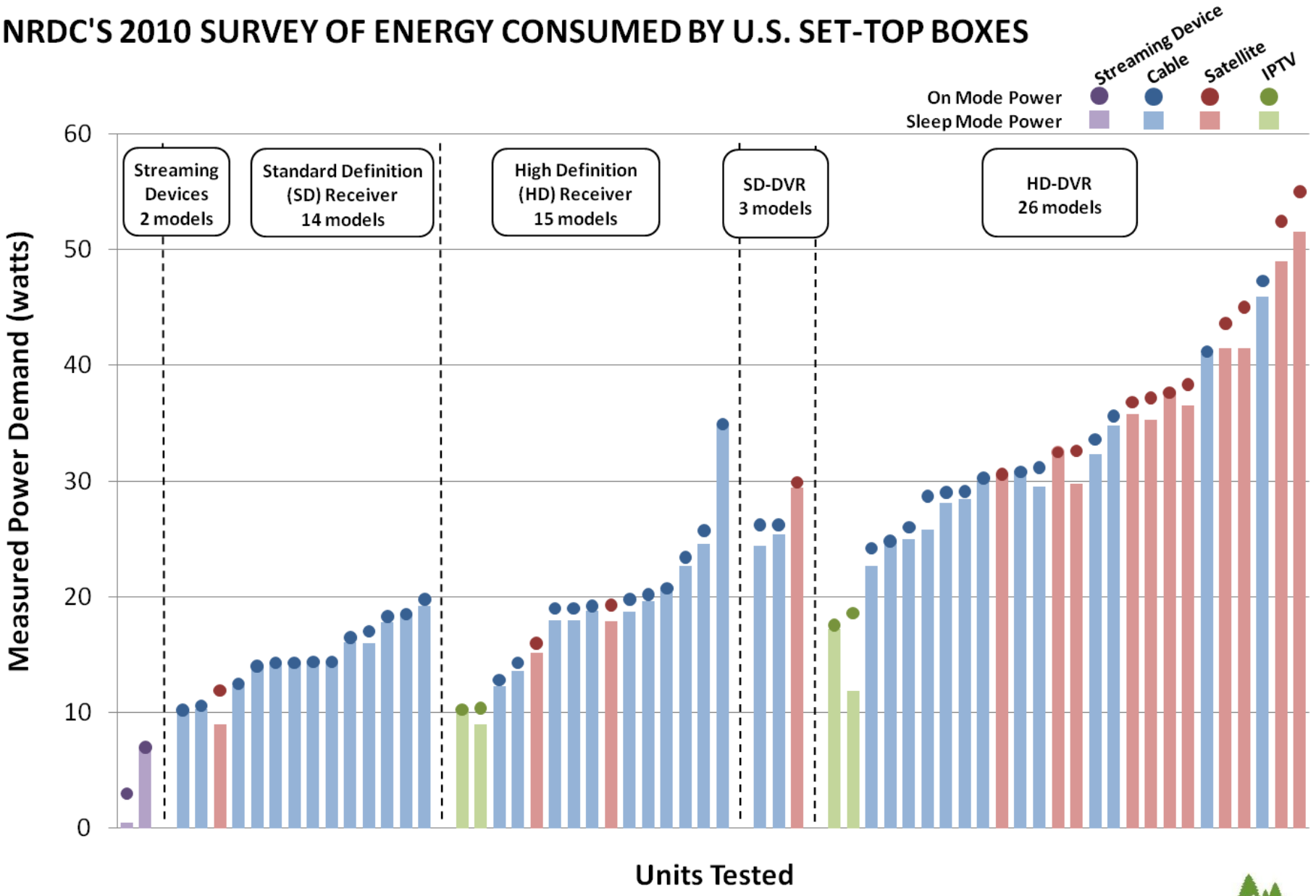
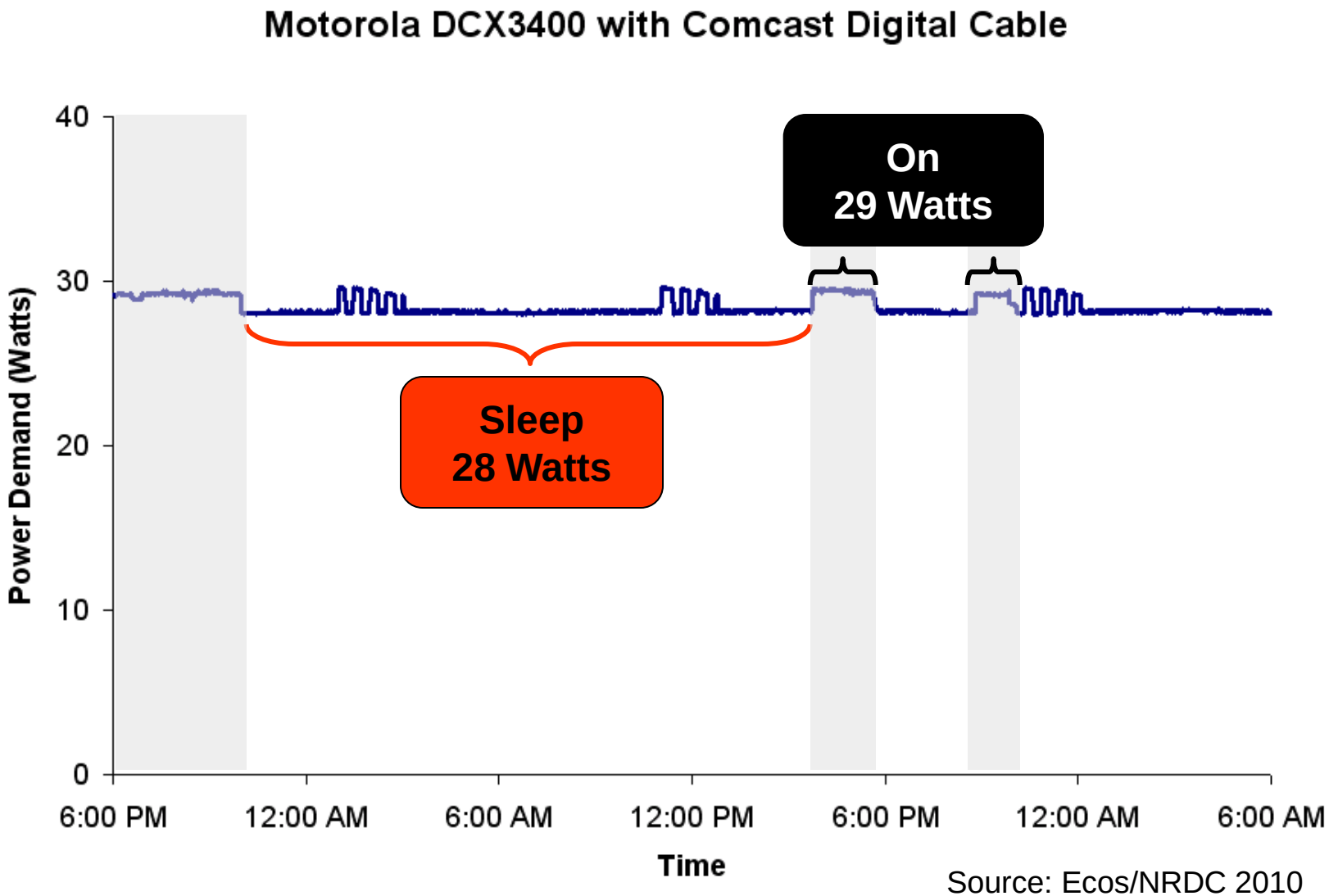
NRDC'S 2010 SURVEY OF ENERGY CONSUMED BY U.S. SET-TOP BOXES

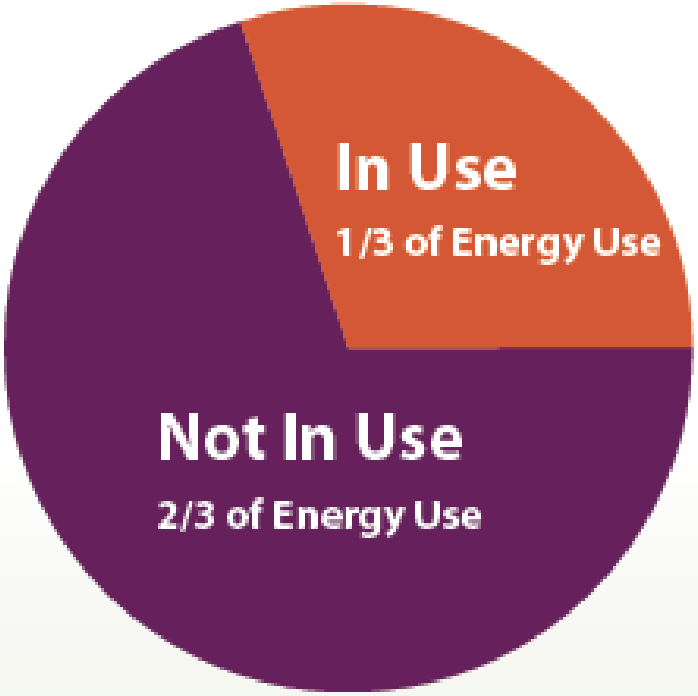


Data Logging Example



Source: Ecos/NRDC 2010

NEARLY TWO-THIRDS OF ANNUAL U.S. STB ENERGY USE OCCURS WHEN VIEWERS ARE NOT WATCHING OR RECORDING CONTENT



Results In…
3 Power Plants (500 MW each)
5 Million Metric Tons CO_2/year
$1 Billion/year

Results In…
6 Power Plants (500 MW each)
11 Million Metric Tons CO_2/year
$2 Billion/year

In Use = watching or recording a show
Not In Use = not watching or recording a show

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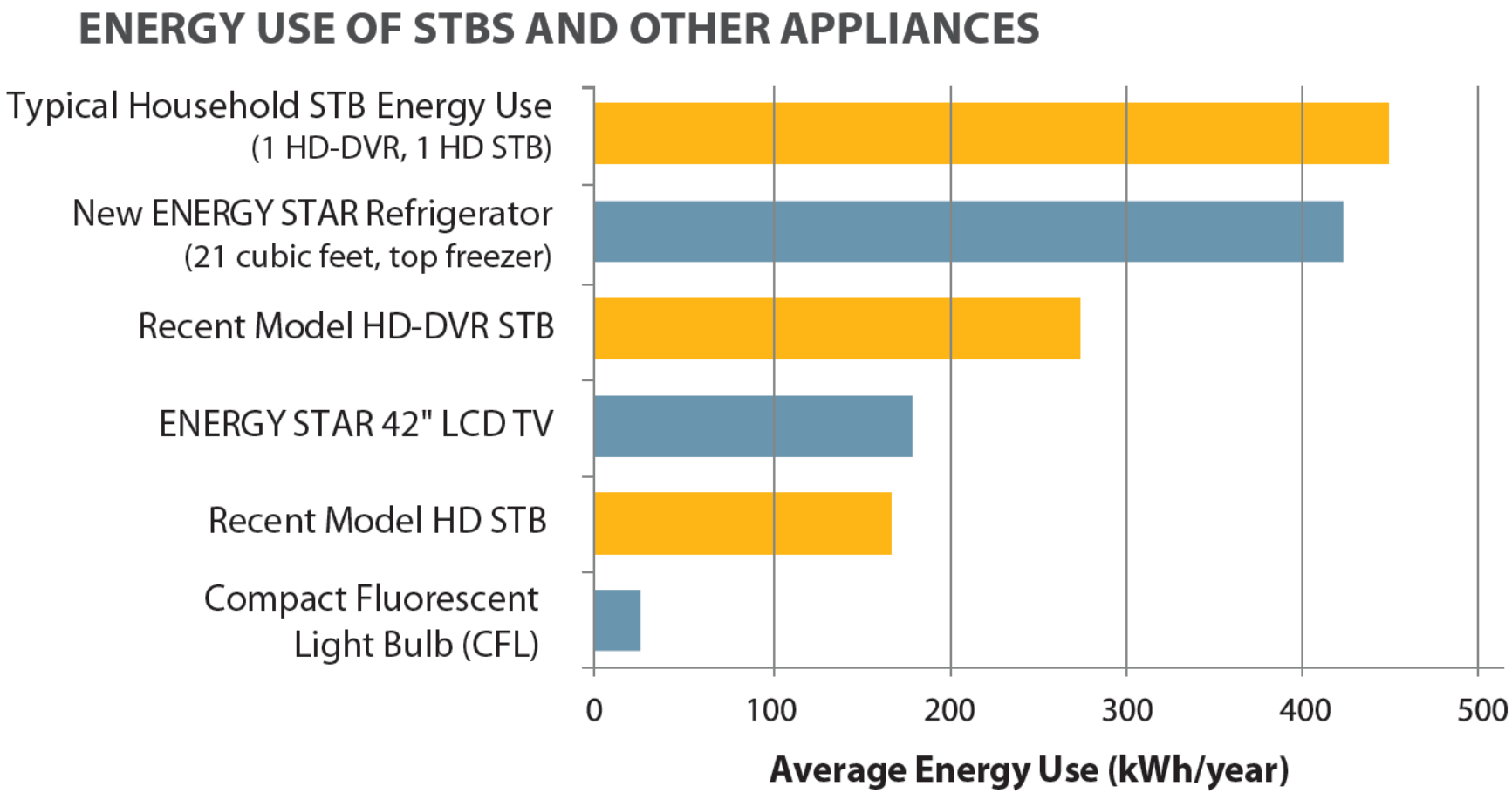
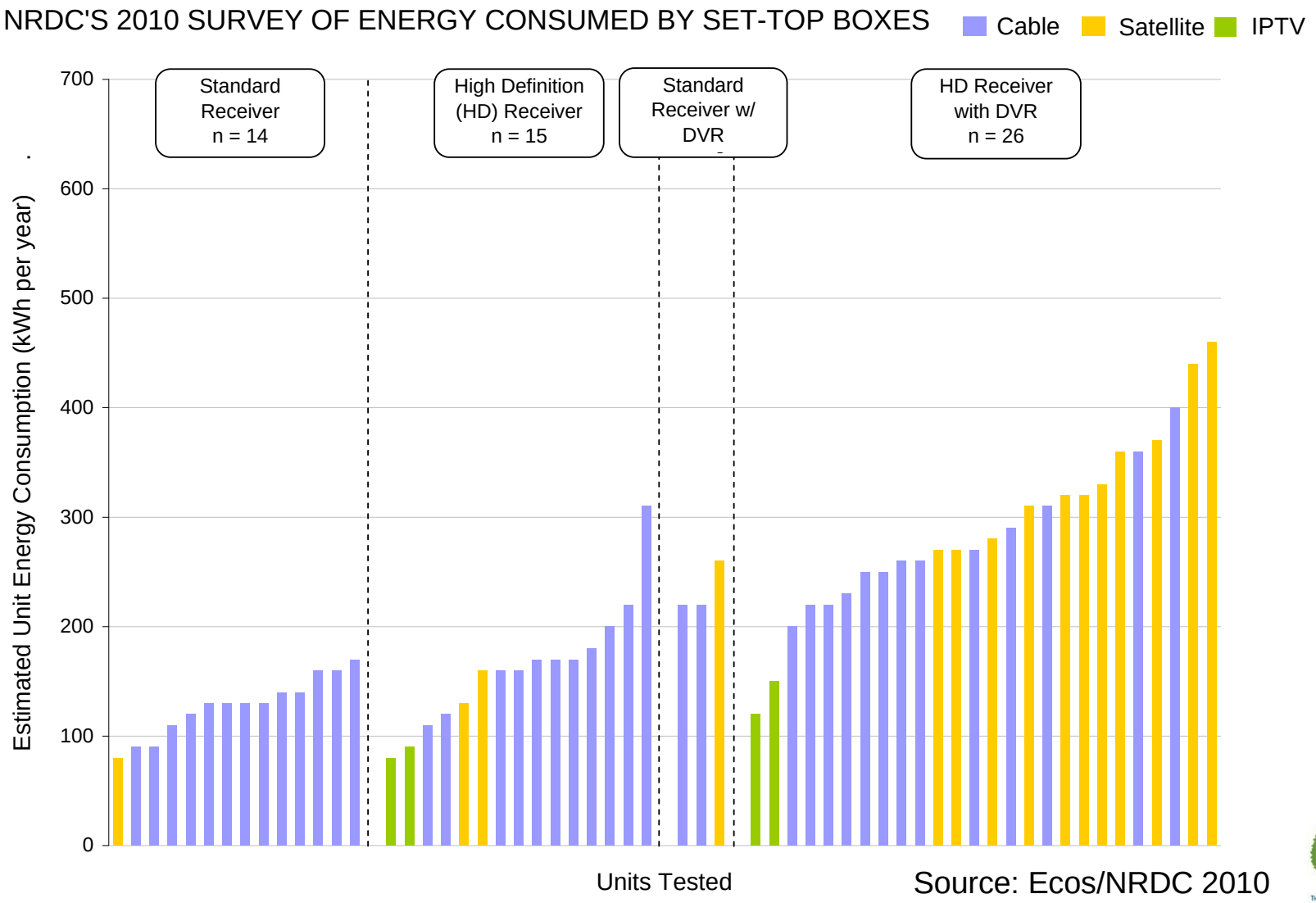
Key Findings/Observations from NRDC-Ecos Study

- Little to no difference in power use when “turned off”
- Category energy use increasing due to growth of DVRs
- Some DVRs consume more electricity per year than new big screen TV they are connected to
- For homes with DVR and basic box, annual STB energy consumption > new ESTAR refrigerator

Energy Use of STBs and Other Appliances



2010 Study Results for All Service Providers



Source: Ecos/NRDC 2010

Observations/Recommendations

- Better designed STB systems could yield annual energy savings of 50 to 75%. Requires cooperation between STB maker AND the service provider.
- Title 20 Options
  - *a) Establish annual KWh/yr limits (TEC) for various types of STBs. Consider ESTAR 3.0*
  - *b) Establish modal limits –*

    Example: New boxes shall not be capable of drawing more than 5 watts when turned off/sleep. Also require boxes to auto power down after extended periods of no user input

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Back of the envelope benefits

- If DVR uses 5 W instead of 35 W in standby ➔ annual savings of 175 kWh/yr. These massive savings achieved without any restrictions for On Mode power use!
- Savings for 3 million DVRs and 14 million HD STBs, upon stock turnover:

Cost savings CA economy* ($ million/year)	$210
Energy savings (GWh/year)	1,750
Power generation avoided (MW)	300
CO2 emissions avoided (Thousand Tons CO2e)	870
CA Households electricity use (Thousands)	240

- Lifetime savings in electricity costs of $45-$90 per device

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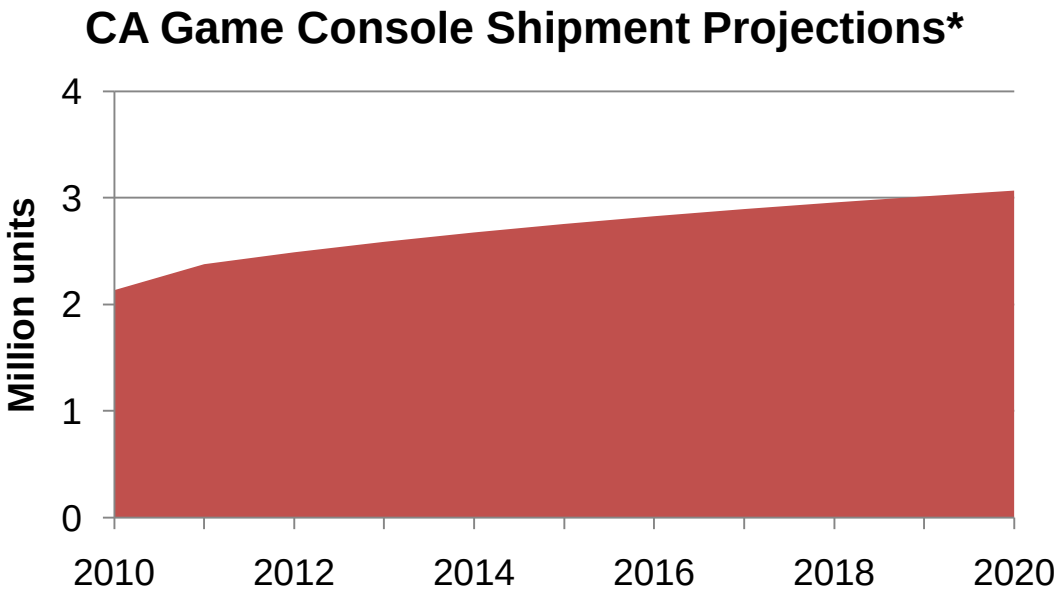
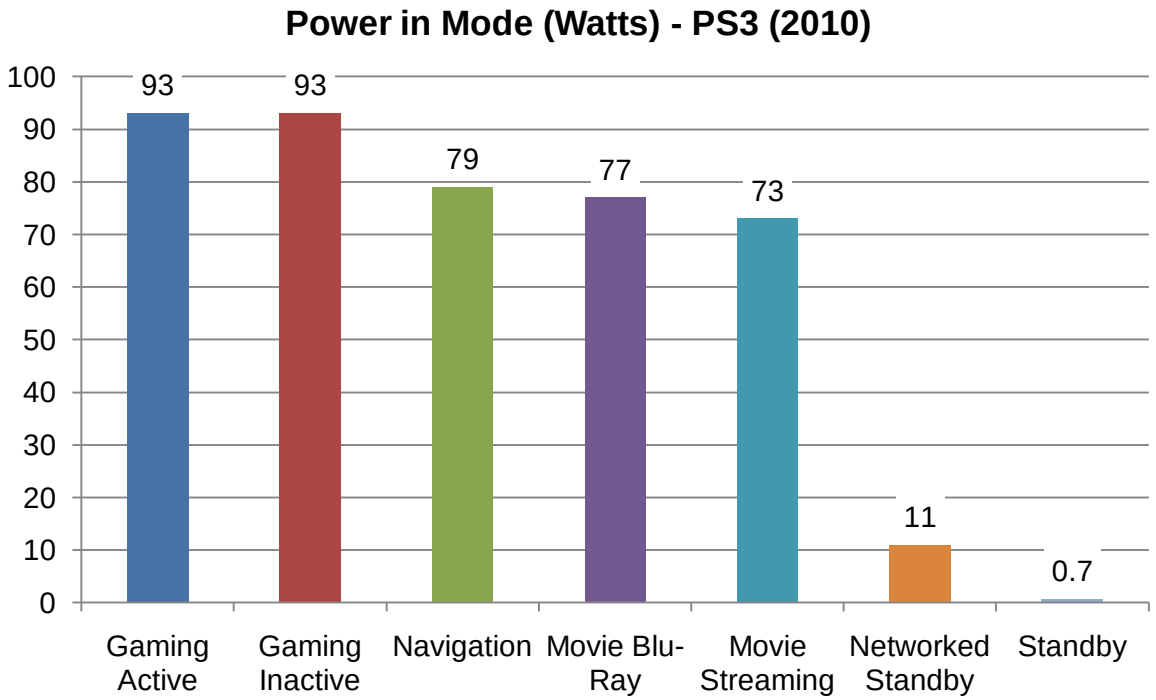
Video Game Consoles



- 10 million game consoles sold in CA 2005-2010, annual CA sales could reach 3 million by 2020
- Console energy use projected to reach 1.5 TWh/yr by 2020

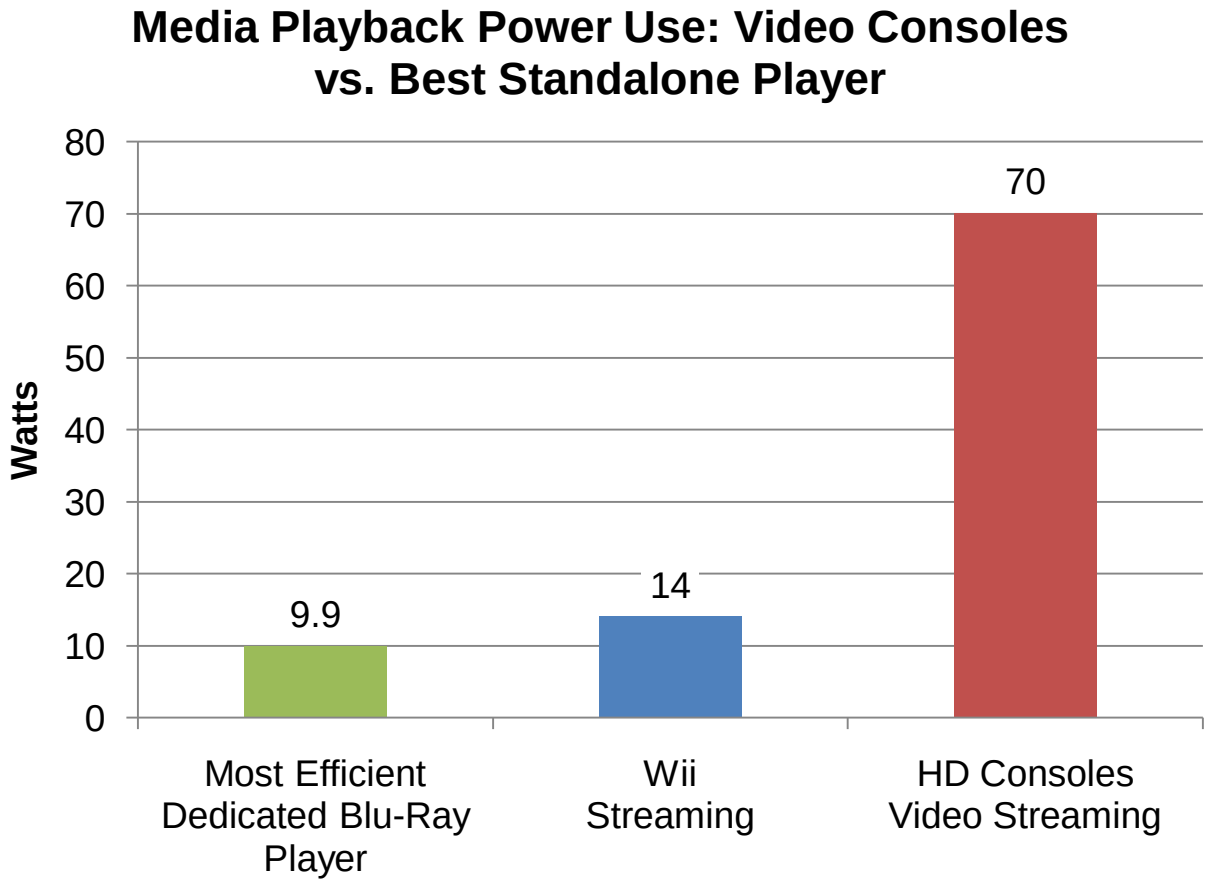
(*) Extrapolation from 2005-2010 sales

Consoles use nearly as much energy in Game Inactive, Navigation or Movie modes as actively playing games



- Auto-power down is critical to ensure consoles go into low-power modes when not being used
- With better power scalability, consoles should use much less energy in Inactive, Navigation and Movie Play modes than in Active Gaming.

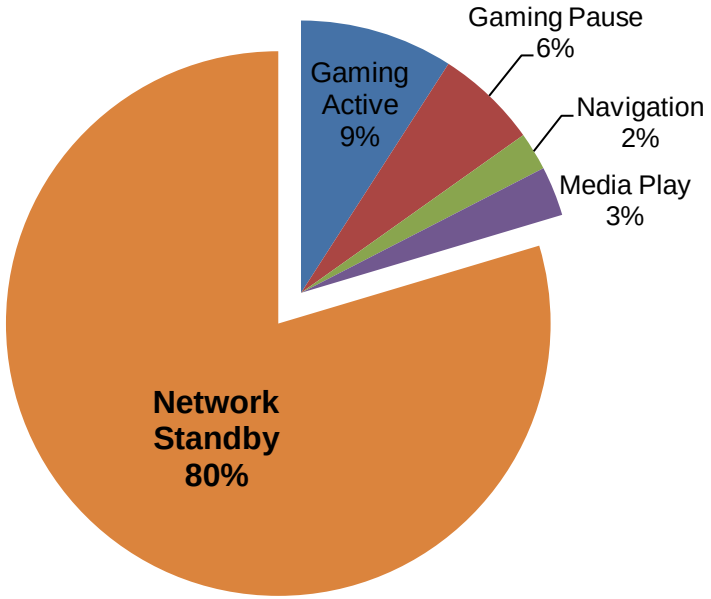
Some consoles use far more energy than the most efficient standalone devices to play movies



- With increasing use of consoles to play movies (both disk-based and streaming), efficiency of console playback is becoming more critical

Beware of Network Standby! When activated, it can be responsible for 80% of console energy use

Annual Energy Use - Wii with WiiConnect24(1)



- When activated, Nintendo Wii goes into Network Standby at 10W, rather than Off at 1W. This translates into 74 kWh of annual energy use when NOT using the console
- Better efficiency in networked standby mode is critical to game console energy savings

(1) With CEA 2010 Study duty cycle

Video game consoles energy savings opportunities

Major opportunities to save energy in game consoles:

- Put console in low-power mode when not in use
- More efficient components: CPU, GPU, RAM, disk…
- More power scalable components that only use as much power as needed in each mode
- Synchronization with TV so that TV switches off when game console powers down

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Straw man standard proposal

Key elements in standard should include:

- Auto-Power Down enabled by default
- Mandatory testing and reporting of energy use in all significant modes per consensus test method
- Power caps in Media Playback, Navigation, Networked Standby modes

Note: Not recommending cap on active gaming mode, test and report only.

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Video game consoles savings estimates

Cost savings CA economy* ($ million/year)	$70
Energy savings (GWh/year)	570
Power generation avoided (MW)	90
CO2 emissions avoided (Thousand Tons CO2e)	280
CA Households electricity use (Thousand)	80

Users that never power off their consoles could save over $200 in electricity costs over life of device.